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PATENT
Attorney Docket No. 033129-056

SPECIFICATION FOR CONTINUATION-IN-PART APPLICATION

BE IT KNOWN, that I, Sunny Behl, a resident of San Jose, California, have invented new and useful improvements in:

REMOVABLE MEMORY STORAGE DEVICE CARRIER HAVING A HEAT SINK

PATENT
Atty Dkt. No. 033129-056

REMOVABLE MEMORY STORAGE DEVICE CARRIER HAVING A HEAT SINK

Cross-reference to related application:

This patent application is a continuation-in-part of US Patent Application No. 08/926,874, filed September 10, 1997.

FIELD OF THE INVENTION

The present invention pertains memory storage device carriers that removably mount a hard disk drive in a computer housing, and particularly to those carriers that facilitate cooling of hard disk drives.

BACKGROUND

U.S. Patent No. 5,673,029 to Behl discloses a hard drive cooling device including a bezel mounted fan. This blows outside air over hard disk drives in a memory storage device bay, cooling hard disk drives in the bay.

Hard disk drives are continually evolving to improve access times, storage capacity, and throughput. Hard drives typically include a platter that spins and a pivoting head that reads and writes data to and from the platter. One way to improve access time is to spin the platter faster. Unfortunately, faster platter speeds may increase hard disk drive temperatures.

Higher hard drive temperatures can decrease the mean time between failure of hard disk drives. Also, when numerous hard disk drives are in a large memory storage system, the sum of the heat generated by the drives drive can heat the system to an undesirable degree. Accordingly, what is desired is an improved way of cooling hard disk drives.

SUMMARY

A device for removably mounting a hard disk drive in a memory storage housing, includes a carrier for holding a hard disk drive. The carrier being removably mountable in a memory storage device housing. The device includes a heat sink mounted on the carrier. Preferably, the heat sink comprises fins mounted on the carrier.

The carrier includes a face and a fan mounted on the face of the carrier, the fins align with respect to the fan to optimize convective cooling. The carrier also includes an air filter mounted on the face to filter air. An air filter cover removably mounts on the face of the carrier to facilitate removal and replacement of the air filter.

The carrier includes lateral rails that slidably mount the carrier in the memory storage housing, and a handle mounted on the face of the carrier to facilitate easy removal and replacement of the carrier in a housing.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the advantages of the present invention, reference should be had to the following detailed description taken in conjunction with the accompanying drawing, in which like parts are given like reference numerals and wherein:

FIG. 1 is the present invention in a memory storage device housing.

FIG. 2 is a memory storage device mounted in a memory storage device cooler.

FIG. 3 is a carrier sliding with respect to a housing.

FIG. 4 is a hard disk drive having an integrated heat sink and carrier.

FIG. 5 is a housing in accordance with the present invention.

FIG. 6 is a heat sink surrounding a memory storage device.

FIG. 7 is a carrier in a housing.

FIG. 8 is a carrier in a housing.

FIG. 9 is a heat sink and a memory storage device cooler mounting on a memory storage device.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a computer including a memory storage device housing generally designated with the reference numeral 10. The memory storage device housing 10 includes a power supply 12, multiple memory storage device bays 13, multiple memory storage devices 14, and memory storage device coolers 16. The power supply 12 powers memory storage devices 14 and the memory storage device coolers 16.

The memory storage device coolers 16 attach within the memory storage device bays 13 to cover the bays 13 and to blow air across the memory storage devices 14 to convectively cool the memory storage devices 14.

Each memory storage device 14 has a surface 18. Each surface 18 is textured to optimize convective cooling. According to one aspect of the invention, each surface 18 includes fins 20. The fins 20 align with airflow from the memory storage device coolers device 16. The airflow is in the direction of the arrows 22.

FIG. 2 shows a memory storage device cooler 16 attached to a memory storage device 14. The memory storage device cooler 16 has fans 30, an air filter 29 with an air filter cover 31, and a carrier 36. The carrier 36 fixes the memory storage device 14 within a memory storage housing, such as housing 10 of FIG. 1.

FIG. 3 shows a memory storage device housing generally designated 34 and a memory storage device carrier 36. The carrier 36 includes a face 37 with a handle 40. The air filter 29 and the cover 31 attach to the face 37. The carrier 36 is configured having for removably holding a memory storage device in the housing 34.

The carrier 36 slides into and out from the housing 34 in the direction of the arrows 135. Removable of the carrier 36 is particularly useful in systems having numerous memory storage devices. In a RAID system, for example, the housing 34 in combination with the removable carrier 36 enables hot swapping of hard drives.

FIG. 4 shows a memory storage device generally designated with a reference numeral 50. The memory storage device 50 includes fans 30, and the carrier 36. The carrier 36 includes cooling fins 20. The carrier 36 is fabricated from a block of aluminum to form a heat sink. The cooling fins 20 align with respect to the fans 30 to optimize convective cooling.

The carrier 36 surrounds a portion of the memory storage device 150 and enables the memory storage device 50 to mount within a housing. According to one aspect of the invention, the fins 20 are integrated with the carrier 36. The carrier 36 facilitates hard drive hot-swappability.

Preferably the carrier 36 covers a portion of the fans 30. The carrier 36 holds the memory storage device, and aligns the fins 20 with respect to the fans

30. According to one aspect of the invention, the carrier 36 and the fins 20 are fabricated from aluminum to optimally conduct heat.

The memory storage device 50 defines an air conduit 52 aligned to receive air flow from at least one fan 30. The fan 30 blows air over the memory storage device 50, along the fins 20 and through the air conduit 52 to optimize convective cooling of the memory storage device 50.

FIG. 5 shows a memory storage device housing generally designated with the reference numeral 60. The housing 60 holds memory storage devices 50. The housing 60 includes a vented cover 62 having an air filter 64.

The memory storage devices 50 are stacked closely and removably mounted in the housing 60. The cover 162 is hinged to facilitate access to the memory storage devices 50. The hinged cover 62 enables easy removal and replacement of the hard disk drives 50.

According to one aspect of this invention, the memory storage devices 50 are stacked closely enough to touch. The fins 20 and fans 30 cooperate to force air flow between the memory storage devices 50 to cool the memory storage devices 50.

FIG. 6 is a perspective view of a heat sink 100 enclosing the memory storage device 14. The heat sink 100 forms a tunnel, in which, the memory storage device 14 mounts. The fan 30 attaches to the memory storage device 14 on one side of the tunnel. The heat sink 100 has an opening 102 at one end of the tunnel which opposes the fan 30. Accordingly the heat sink 100 operates as a conduit to direct air from the fan 30 along the exterior of the memory storage device 14 so that the heat sink 100 can closely stack multiple memory storage devices in a memory storage housing (FIG. 5) without overheating.

FIG. 7 shows the a carrier 36 inserted into a housing 34. The carrier 36 includes the fins 20. Accordingly, the carrier 36 and the heat sink 100 (FIG. 6) are integrated.

FIG. 8 shows the heat sink 100, with fins 20. The heat sink 100 attaches to the carrier 36, forming a cover. Preferably, the heat sink 100 is removable. According to one aspect of the invention, the heat sink 100 slides with respect to the carrier 36, exposing the memory storage device 14.

FIG. 9 shows the heat sink 100 and the memory storage device 14. The heat sink 100 surrounds a portion of the memory storage device 14. A memory storage device cooler 16 attaches to an end of the heat sink 100. The heat sink 100 functions as the carrier 36, having lateral rails 39 to facilitate a sliding engagement with a memory storage device housing.

While the foregoing detailed description has described various embodiments of the invention it is to be understood that the above description is illustrative only and not limiting of the disclosed invention. Accordingly, the invention is to be limited only by the claims.